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The data processing programmer supplies the element of intelligence to the electronic computer. His instructions, "the program," provide the directions, which enable the computer to perform a given task.

This occupation was not even envisioned 25 years ago, yet today it is one of the fastest growing in the country. The electronic computer is just beginning to make a major impact on our economy. Its potential market is very great at present, and every day more uses are being found for it. Work as a programmer offers an opportunity for a satisfying career with an excellent outlook for the future.

Electronic Computers

The electronic digital computer is one of the great inventions of our time. It is one of the group of electronic mechanisms that undoubtedly will have a revolutionary effect on our lives by advancing science and minimizing the routine detailed aspects of some work.

Digital computers can perform the most complicated mathematical calculations in phenomenally short time; for example, some can add two large numbers in less than one millionth of a second. A mathematical problem requiring millions of calculations can be done by an electronic computer in seconds.

Computers can perform other functions, such as making comparisons, bringing together certain types of data, and choosing between alternatives. They store information and bring it out when needed. Some large computers can execute 100 different mathematical, logical, or data processing operations.

However, computers cannot think. They must be given careful, detailed instructions in a very simple form. Basically, the machines operate on a yes or no system. They do everything by making a choice from two possibilities. The instructions are, therefore, broken down into a series of very small steps to permit such simple choices.

Most computers are the central unit of an information handling system. Auxiliary equipment

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Photo by H. Armstrong Roberts

is attached to it to increase its ability and to use its great computational speed. Among these are machines that prepare the data for the computer and printers that print the computers' solutions.

The system is controlled by a control console. Data can be entered into the computer from punched cards, punched paper tape, typewriters, magnetic tape, high speed magnetic drums and discs. The larger computers often have a combination of these devices, whereas, the smaller ones generally rely upon a few types of input devices.

The computer is beginning to prove a powerful tool for implementing comprehensive management information systems that integrate the data flow between different functions of a business and provide management with faster, more accurate and more meaningful information for business decisionmaking than could be achieved through traditional clerical methods. Also, in business the

computer provides the means to reduce the ever-growing large volumes of clerical paperwork and the immense amounts of time and manpower spent on routine clerical work in the office and factory.

The Programmer's Job

The programmer plans and organizes the manner in which the computer will operate to carry out a given job. Usually the work is grouped into four steps. The first is to analyze the problem. Is it a problem that can be handled by the computer? If it is, what will be the general method of using the computer? This is followed by the second step, preparing a flow chart which expresses the machine operations in general terms. The third step is to refine the flow chart into completely detailed machine instructions. Every step necessary to carry out the whole project is written out in a code the machine can "understand" and obey. These are the machine's instructions. Finally, the instructions are tested on the machine and the necessary changes are made if errors show up.

Programmers work closely with systems analysts to define problems, analyze the input data and output report requirements, and prepare a program of instructions which the computer can follow to solve the problems. The highly detailed nature of systems and programming work requires strong logical and creative abilities.

In planning to use an electronic computer to do business programming, to understand the kinds of reports needed and their timing, the programmer must have discussions with company personnel at all levels. When all the information is assembled, the programmer prepares a flow chart showing the logical order in which various operations must be performed by the machines. He then writes the many hundreds -- often thousands -- of program instructions. The final instructions are coded into special machine language by the computer, which then is converted into holes on punched cards and paper tapes or marks on magnetic tapes.

Programmers engaged in solving scientific or engineering problems also perform analytical work, prepare flow charts, write instructions, and test their programs. In this work, however, the programmer deals chiefly with scientists and mathematicians who present the problem in complicated mathematical formulas, which the programmer has to simplify into arithmetic steps the computer can handle.

In offices with large computing systems, several programmers at different levels of responsibility may work as a team on one problem. A senior programmer may have responsibility for the entire program and may direct other programmers. Beginning or junior programmers

are usually assigned to write specific parts of broad programs.

Working Conditions

The programmer usually works in a well-lighted, air-conditioned office. No particular physical requirements are needed. There is an element of painstaking concentration in his work because of the need for attention to details. A tiny error may require time-consuming corrections in a program.

The usual workweek is 35 to 40 hours a week in industry, and 40 hours in the Federal Government. A programmer may work evenings and weekends if he is at a point where he is trying out work on the machine and he must make quick changes in the instructions.

Programmers usually receive liberal vacations, paid holidays, and sick leave and are covered by life insurance, pension, hospital, and medical benefit plans.

Salaries

Programmers' salaries vary widely. Starting salaries for programmers in business firms average about \$7,300 a year, according to industry and location. Salaries are generally increased annually for a few years. For programmers with supervisory duties, salaries can range from \$12,000 to \$20,000 and up. In the Federal Government, salaries for most programmers are comparable with those in private industry. Higher salaries are earned by top level administrators responsible for programming work in government, as well as in industry.

A scientific programmer who is a college graduate can start from \$7,000 to \$9,000, and an experienced systems analyst may earn as much as \$17,000.

Personal Qualifications

Probably a programmer's most important personal qualification is a logical and analytical mind. He must be accurate, have intellectual curiosity, ingenuity, patience, and be capable of independent thinking. He should be able to shift his thinking easily, as for example, from work requiring creative thinking to that concerned with a mass of details. Being good in mathematics is not an infallible indication of success in this work.

Educational Requirements

Education requirements for this occupation are not yet standardized. Some employers find it practical to train people with only high school education, while others think a college degree is necessary. Employers often recommend such courses as logic, mathematics, engineering, or science. Courses in business administration,



Photo by A. Devaney, Inc.

accounting, and statistics are also helpful.

Practically all organizations using their computers for scientific and engineering work require their programmers to be college graduates with degrees in engineering, physics, mathematics, or computer science. Graduate degrees may be required for some positions; for almost all, an applicant who has no college training is at a severe disadvantage.

Employers who use computers to process business records generally place somewhat less emphasis on the need for college training. Many regard previous experience in related work equally important and fill many of their programmer positions by promoting qualified employees with such experience. However, when they find it necessary to hire outsiders, many give preference to applicants with education beyond high school. College courses in the general field of data processing, or in accounting, business administration, engineering, or mathematics are regarded as especially good preparation.

Federal Civil Service requirements specify a college degree or equivalent in experience for practically all beginning jobs in programming.

Many employers of business data processing programmers are also requiring a minimal business administration education, some even a business degree, for programmers engaged in the implementation of integrated management information systems.

Training for the Work

In this early state of the occupation, specific

training is generally the responsibility of firms using computer equipment and manufacturers of the equipment. Manufacturers set up training programs to which equipment users send trainees. Frequently, after an organization has had experience in the work, it sets up its own in-service training program.

In a typical in-service program, the trainee spends several weeks on a combined lecture and practical demonstration series. Then he is given practice in writing and coding instructions and in testing the program on a computer. The student then spends some weeks in practice work with the computer. A usual training program varies from several months to a year.

Many colleges and universities in the United States offer courses in programming a computer, usually with a computer readily available on campus. Many more teach at least a basic course in programming.

Every year, new courses in data processing are offered by high schools, business schools, junior colleges, colleges, and universities. A number of technical high schools and colleges offer this type of training, usually within their business departments. Many private business schools are now expanding their offerings to include computer programming classes.

Data processing courses are usually found within the departments of business, engineering, or mathematics. New departments of computing science are being organized also. Full two-year college curricula in business data processing are offered by an increasing number of junior colleges. Some four-year institutions have bachelor's degree programs, and a growing number of graduate schools offer master's and doctor's degrees with majors in computer sciences and business data processing.

Promotional Opportunities

Opportunities for promotion in this work are good. Electronic computer systems are relatively elaborate. They require trained personnel with a variety of skills. Programmers in a typical organization perform at several levels. A senior programmer is usually responsible for a complex programming job and supervision of other programming staff. Below him may be one or more programmers who carry on large parts of complex programs or prepare moderately difficult jobs. Junior programmers carry out work on simple programs or program parts following plans prepared by someone else. With the need for programmers constantly growing, programmers are able to move up the ladder almost as quickly as they gain skill and experience.

An authority in the field has said, "I personally feel that opportunities for advancement will be

more and more reliant upon higher education." However, there are continuing opportunities for those at all educational levels who can demonstrate through programmer aptitude tests that they have strong logical abilities and a capacity for detail.

Employment Outlook

All signs point to an extraordinary increase in employment in this occupation. There are now over 100,000 programmers at work. This, of course, includes systems analysts and specialists, such as mathematicians, whose primary duties are related to computer programming.

The future market for electronic computers appears to be very great. The computer is an essential tool in the rapidly growing scientific and engineering research for military and civilian purposes. Its use is expanding and is just beginning in equipment for factory automation. A growing number of companies are applying computer techniques to their work. Despite the many changes and improvements which have already taken place, computer technology is still in a comparatively early stage of development. As further changes will improve the computer, its use will expand into areas not yet thought of.

The use of electronic data processing equipment is expected to increase very rapidly, and as a result the number of jobs for programmers will also increase.

Where Employed

The principal employers of programmers include computer manufacturers, the U.S. Government in both military and civilian agencies, research organizations, insurance companies, public utilities, and scientific and engineering laboratories. Manufacturers employ them in offices and warehouses and on production inside the factory. Programmers are employed in such industries as electrical equipment, aircraft, petroleum, chemicals, steel, and banking. An increasing number are employed in specialized computing service firms, which provide computer work on a fee basis. Such firms have been set up in many large cities.

For Further Reading

Electronic Computer Operating Personnel, Programmers, Systems Analysts. Occupational Outlook Bulletin #1550-32. 10¢.

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

The ABC's of ADP. 15¢.

Your Career in Data Processing. 2¢.

Future Data Processors. Free.

Certificate in Data Processing. Free.

Data Processing & Computer Courses at Universities and Colleges. Free.

The DPMA Certificate in Data Processing. Free.

Data Processing Management

505 Busse Highway

Park Ridge, Illinois 60068

Programming a New Profession for You. Single copy free to counselor.

Electronic Computer Programming Institute
Empire State Building

New York, New York 10016

Your Career in Computer Programming. \$3.64.

Julian Messner, Div. of Simon & Schuster, Inc.
1 West 39th Street

New York, New York 10018

For Further Information

A list of reading materials on career opportunities in programming may be obtained from:

Association for Computing Machinery
211 East 43rd Street
New York, New York 10017

American Federation of Information
Processing Societies
345 East 47th Street
New York, New York 10017

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